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most of them. On one a face was visible in the midst of a cotton-wool effect; the others had crude markings, ascribed by the medium to unformed "ectoplasm" or to "spirit lights." As will be observed, she had acquired some of the latest spiritualistic terminology. At the second sitting, arranged by Mrs. McKenzie, a sealed box of six plates, forwarded in accordance with instructions, was produced by the medium. The box was opened and the plates transferred to metal dark slides; a service was then held, hymns being sung, and the Lord's Prayer recited. The plates were then exposed and an "extra" appeared on one of them—on No. 1 plate—which the investigators satisfied themselves had been substituted for the first plate of the original package. The medium had by this time become suspicious and nervous, and in fact she was not equal to holding her own with professional conjurers. She, however, consented to a third sitting, and for this an unopened box of unprepared plates was sent. It therefore became necessary that the plates should be secretly marked before being placed in the dark slides. One of the investigators, having placed the open stack of plates before the medium under the ruby light, secretly attached a small pad of pink material, chemically prepared, to the ball of his right thumb, and in handing the plates one by one to the medium an invisible mark was impressed on each. The medium gathered up the slides, and going into the studio took them to a small table on which her handbag was standing. The ostensible object was to obtain the hymn-books for the service, but the move being anticipated, the members of the deputation placed themselves in convenient positions to observe her actions. The hand holding the slides was seen to be placed inside the bag; one slide was dropped into a side pocket and a duplicate slide picked up with the hymn-books. Four plates were developed, and on one which did not show the mark a "spirit extra" appeared. All this may be amusing to the cynic, but the conclusions the committee of the Magic Circle draw are that although spirit photographers, like conjurers, meet changing conditions by the adoption of new methods, there are at present at least two methods in general use by some,

at least, of the mediums who devote themselves to obtaining photographic "extras." In the one case, when the plates are accessible before the sitting, the spirit form is impressed, in advance, by contact with a selected transparency. In the other, when the packet is not available beforehand, the exchange for a prepared plate is made by a subtle move after the original plates have been loaded into the dark slides. The committee assert that they have never imposed a test which would not have served to demonstrate the straightforwardness and honesty of the medium, and conclude with a promise to extend to any honest medium fair, impartial and courteous treatment, and to give him a free hand to carry out the experiment in his own way.—*British Medical Journal*.

SCIENTIFIC BOOKS

The Evolution of Climates. By MARSDEN MANSON. 1922. Published by the author.

DR. MANSON has been long and widely known as a student of geologic climates. When his attention was first directed to the subject the currently accepted theory—which indeed still persists—postulated the solar control of terrestrial temperatures similar to that which now dominates such temperatures, but it early became apparent that not all of the problems presented could be satisfactorily solved under this assumption. For instance, the non-zonal distribution of climates such as certainly obtained during at least the major part of pre-Pleistocene time, the frequent recurrence of mild temperatures in polar areas, glaciation at or near sea level in and adjacent to the tropics, etc., have not been satisfactorily explained on the basis of exclusive solar control. This leads to the postulate of a dual heat supply—that is a part derived from the earth itself and a part from the sun. The manner in which this postulate works out and the solution it seems to afford to the various problems involved is set forth in the present paper.

In 1903 Dr. Manson published a preliminary paper under the same title as the present one, in which he reviewed the various theories that have been proposed to account for the origin and distribution of climatic differences, and

after practically twenty years of investigation, reading, and correspondence the present work can be considered as a summation of results. It is divided into three parts, the first of which sets forth the scope of the problem, while the second part deals with the application of the principles set forth to the facts of paleontology and geology, and the third to a recapitulation of conclusions and their general application.

Dr. Manson of course recognizes that on account of the low conductivity of the earth's crust it has been held by physicists and mathematicians that this source was inadequate as a factor of importance, but after reviewing the data on which this assumption is based he "feels obliged to reject the conclusions as 'incompetent, irrelevant, and immaterial.'" He holds that "both earth heat and solar radiation prevailed as active factors in temperature control during all of the eras of geologic history and until the modern era of solar control; that the former was available as ocean stored heat, but the supply was held in the forming crust by reason of its low conductivity and was slowly made available by denudation and the exposures of radio-active materials, etc., or by periodic changes in the topographic form of the earth's surface which made increments of the interior sources of energy available."

This earth heat warmed the early oceans, the first effect being to increase evaporation and cloud formation. This ocean stored heat was conserved by the moist air and clouds and in part restored by the effects of solar radiation. This continued until the exhaustion of earth heat was registered by the cold oceans of Pleistocene time.

The causes for the initiation of glaciation as well as the alternation of glaciation and deglaciation or inter-glacial periods have given rise to almost endless speculation. Many students have stated frankly that they can see no possible or reasonable explanation of, for instance, the Permo-Carboniferous glaciation that occurred in or adjacent to the tropics, under direct solar control, and under this assumption this is about the only conclusion that can be reached. But Dr. Manson offers an explanation that is not only logical but

seemingly possible not to say probable. He says: "The two conditions essential for glaciation are: (1) *Cold Continental Areas*—cold from more rapid chilling when remote from ocean influences, from elevation, from exposure to cold anti-cyclonic winds, and, upon the final loss of efficient earth heat; (2) *Warm Oceans*, to supply water vapor in sufficient amounts to deeply glacialize and to maintain continuous cloudiness to intercept solar energy."

"Land areas chilled prior to the oceans and were therefore exposed to glaciation. Furthermore in cooling oceans each of these impairments occurred at a critical temperature; first that degree which could just maintain cloud density in zones of minimum cloudiness; and lastly, that degree which could just maintain cloudiness in zones of maximum cloud density. Moreover, if, during the existence of either glaciation, the oceans should fluctuate in temperature to points somewhat above or somewhat below these critical temperatures, corresponding variations in the generation of water vapor would necessarily follow, imposing variations in the integrity of the cloud sphere in each latitude. Each fall below this critical temperature would impair the cloud sphere, and each rise above this temperature would restore it, thus alternately exposing the surface to solar energy and shutting off the same until the oceans again chilled below the critical temperature."

This in brief outline is Manson's explanation of the phenomena of glaciation and deglaciation. The theme is of course fully elaborated in the paper, and whatever its fate may be it is something that will have to be reckoned with by all future students. All will admit that any explanation that is put forward to account for glaciation or deglaciation must apply equally to these phenomena wherever they occur, and while many theories have been proposed that may seem to cover particular cases they fall short of accounting for all. Dr. Manson's explanation applies as well to the Huronian and Permo-Carboniferous as to the Pleistocene glaciation. It is a notable contribution.

F. H. KNOWLTON